

Leukocytoclastic Vasculitis in a 66-Year-Old Woman After Fusion of the Second Right Metatarsocuneiform Joint Using Titanium Plate and Screws: A Case Report

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ABSTRACT

Metallic orthopaedic implants are known to instigate cutaneous reactions; however, the mechanism by which this occurs is not fully understood. Contact dermatitis after implantation of stainless steel fracture plates was first described in 1966, and similar reactions to various implants have been documented subsequently. Leukocytoclastic vasculitis (LCV) is an inflammatory condition of small dermal blood vessels resulting from neutrophil invasion, degranulation, and cell death caused by a type III hypersensitivity reaction. No studies have reported use of titanium orthopaedic implants resulting in LCV. We describe a 66-year-old woman who developed LCV after the fusion of her second right metatarsocuneiform joint with a titanium plate and screws. At 4 months after removal of the titanium plate and screws, the LCV symptoms had resolved without further intervention. Although this rash might be a rare complication associated with orthopaedic implants, it is an important differential diagnosis for orthopaedic surgeons to consider when assessing and treating postoperative rashes.

Keywords: Leukocytoclastic Vasculitis, Titanium Implant, Rash

INTRODUCTION

Leukocytoclastic vasculitis (LCV), also known as small vessel vasculitis or hypersensitivity vasculitis, is a skin condition characterized by palpable, non-blanching, purpuric papules on the lower extremities and occasionally on the back and buttocks (Figure 1A

and 1B).¹⁻⁵ The condition typically involves the lower extremities; however, it can affect any region of the body.²⁻⁵ LCV may present as vesicles, skin ulcerations, and areas of necrosis.¹⁻³ Although uncommon, systemic symptoms can include pruritus, malaise, fevers, lower-extremity edema, arthralgias, and myalgias.^{2,4}

LCV is a type III hypersensitivity reaction resulting in inflammation and vasculitis, typically caused by neutrophil invasion, degranulation, and cell death.¹⁻⁴ Type III hypersensitivity reactions trigger the production of immune complexes that stimulate circulating neutrophils to release proteolytic enzymes, resulting in inflammation and damage of adjacent vessel walls.⁴ LCV is usually idiopathic; however, the condition is also associated with many chronic diseases, medications, and infections.²⁻⁵ We were unable to find evidence to support titanium or other metallic orthopaedic implants mediating LCV reactions, but orthopaedic implants have been shown to instigate hypersensitivity reactions including dermatitis and lymphocytic vasculitis.^{6,7} If the instigating cause is removed, most patients with LCV experience spontaneous resolution of their skin lesions within weeks or months of initial onset.³⁻⁵

Mild cases of LCV are treated with elevation, rest, and antihistamine therapy.³⁻⁵ In patients with more severe symptoms, corticosteroids are used to prevent further exacerbation.³⁻⁵ We describe a 66-year-old woman who developed LCV shortly after the fusion of her second right metatarsocuneiform joint with the use of a titanium plate and screws.



Figure 1. Representative photograph of leukocytoclastic vasculitis. A) Left foot. B) Both legs. Photographs reprinted with permission from James Heilman, MD, <https://commons.wikimedia.org/w/index.php?curid=11857197> and from DermNetNZ, https://knowledge.statpearls.com/chapter/0/24215?utm_source=pubmed, respectively.

CASE REPORT

A 66-year-old woman presented to the orthopaedic clinic with chronic pain and degenerative joint disease in the second and third tarsometatarsal joints of the right foot. The patient had a history of tenderness and bossing over the second and third tarsometatarsal joints, thus requiring her to use a walking boot due to chronic pain. Nonsurgical interventions were attempted without resolution of pain (ie, various shoe wear, bracing, and fluoroscopically guided injections). Her medical history revealed non-localized allergic concerns to stainless steel and certain metallic jewelry; however, she could not characterize the type of allergic reaction she experienced. Because of her unknown allergy status to stainless steel, the decision was made to proceed with surgical intervention using a titanium plate and screws.

The patient underwent fusion of the second right metatarsocuneiform joint, and arthrotomy and debridement of the third metatarsocuneiform joint.

The joint surface of the second metatarsocuneiform joint was prepared for fusion. While the joint was held compressed, the titanium plate was placed dorsally and filled with titanium screws. The wound was irrigated and closed. The procedure resulted in successful bony contact and stable fixation of the joint (Figures 2A through 2C). Postoperatively, no complications were noted and the patient described feeling well.

At 2 months after the initial operation, the patient developed a pruritic rash on her right lower extremity, sparing the toes. She was evaluated by The University of New Mexico Department of Dermatology 1 month later. At that time, she had a pruritic rash on the right ankle and distal right lower leg, with minimal involvement of the left lower leg. About 36 hours before the onset of the rash, she described herself as feeling “under the weather.” It was noted during physical examination that the patient had non-blanching, palpable, purpuric papules on both legs, sparing the toes. Findings of two separate punch biopsies of the rash indicated neutrophil fragments, extravasated

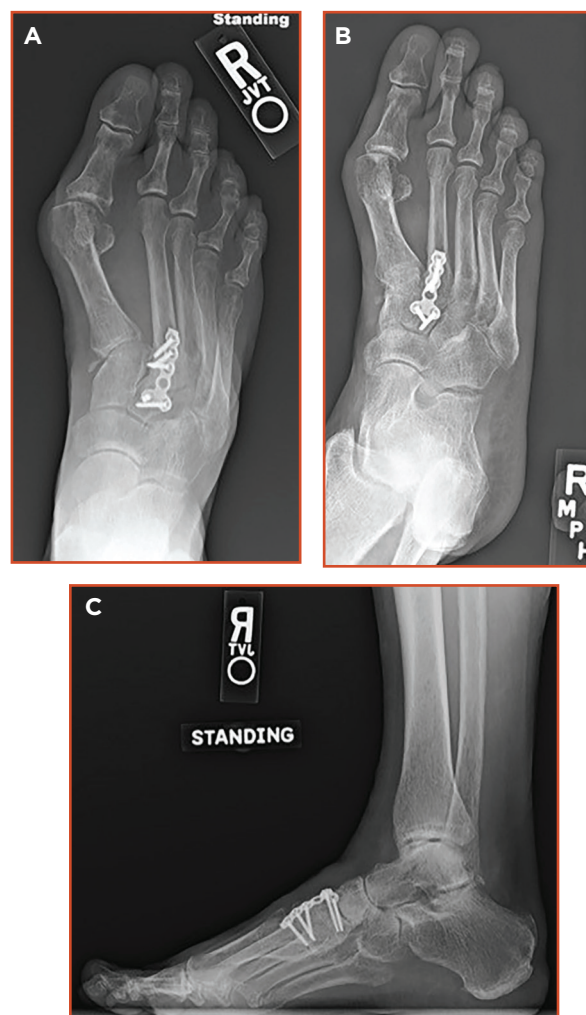


Figure 2. Radiographs showing the titanium plate and screws at the second right metatarsocuneiform joint. A) Anteroposterior view. B) Oblique view. C) Lateral view.

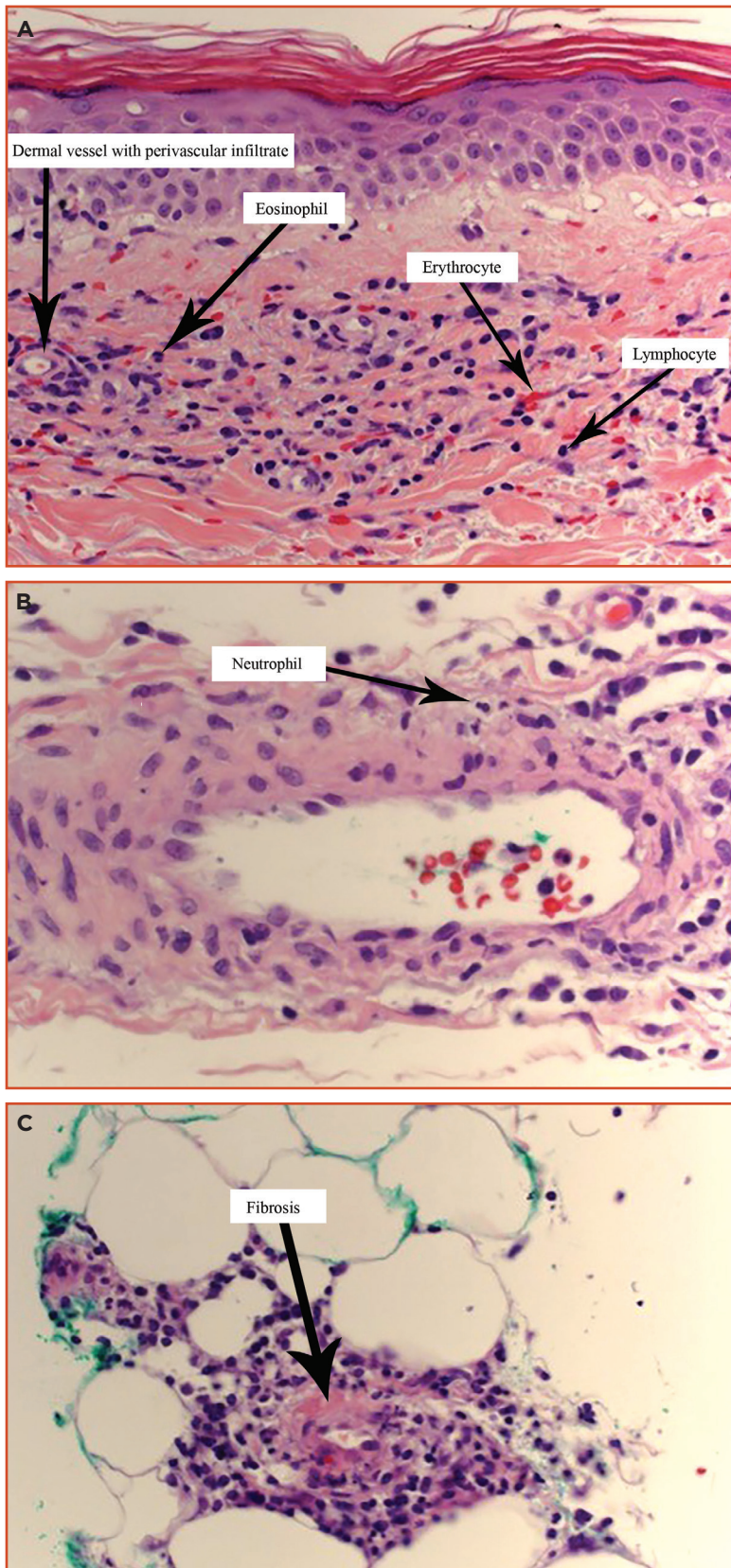


Figure 3. Tissue histological sections. A) Perivascular infiltrate composed of lymphocytes, eosinophils, and a few neutrophils. Presence of copious extravasated red blood cells (black arrows) are also noted. B) Dermal vessel with neutrophil fragments near vessel wall (black arrow). C) Dermal vessel that appears to have been damaged with fibrinoid material in vessel wall (black arrow).

erythrocytes with uncommon perivascular neutrophils, and granular deposition in the vessel walls consistent with LCV of unknown origin (Figures 3A through 3C). The patient was re-evaluated by a dermatologist multiple times because the rash did not resolve with treatment using triamcinolone cream and 20 mg of oral prednisone once a day for 5 days. No diagnosis was made, but it was speculated that the titanium plate and screws might be related to her condition.

At 6 months after her metatarsocuneiform fusion, the patient underwent removal of the titanium plate and screws from the joint. Stress of the joint after removal of the plate and screws showed successful arthrodesis. The implants removed showed no damage, and there were no signs of debris in the adjacent soft tissues. At 1 week postoperatively, symptoms of LCV resolved. Four months later, at the final follow-up, no reoccurrence was noted.

DISCUSSION

Metallic orthopaedic implants are known to instigate cutaneous reactions, but the mechanism by which this occurs is not fully understood.⁸ In 1966, contact dermatitis after implantation of stainless steel fracture plates was first described, and similar reactions to various implants have since been documented.⁶⁻⁸ Nickel, cobalt, and chromium are more likely to induce cutaneous and extracutaneous reactions; however, other metals can be immunogenic and produce similar effects.⁶⁻⁸

Cutaneous reactions after metal exposure are relatively common, although reactions are less seen in metallic orthopaedic devices compared to other implants.^{6,7} There is an ongoing debate of the validity of developing cutaneous reactions from metallic orthopaedic implants, specifically because the implants are inserted deep within the tissue and away from the overlying cutaneous tissues.^{6,7} Metal hypersensitivity reactions typically present as contact dermatitis on the overlying skin that was exposed to the metal irritant, including both implanted metal and metal that directly contacts the skin on the surface.⁶⁻⁸ Typically, contact dermatitis presents as an eczematous reaction with erythematous scaling plaques and papules in the area of contact; however, it can occasionally present with microvesiculation, depending on the timing and extent of allergy.⁶ The eruptions normally occur over the site of the implant and do not spread from the site of origin or to adjacent extremities.^{6,7}

Over time, metallic orthopaedic implants experience normal wear-and-tear that releases haptens (antigens), which in-turn induces a counter hypersensitivity reaction.⁷ Haptens activate lymphocytes resulting in a humoral immune response, including antibody and immune complex formation characteristic of types I to III hypersensitivity reactions.⁷ More commonly, orthopaedic implants induce type IV hypersensitivity reactions that cause inflammation through cytokine secretion and macrophage recruitment.⁷ LCV is representative of a type III hypersensitivity.¹⁻⁴ We were unable to find any reports of titanium orthopaedic implants resulting in LCV. In the current case, our patient's condition represents an atypical hypersensitivity reaction to a metallic orthopaedic plate and screws.

Currently, it is not possible to predict which patients will develop hypersensitivity reactions to metallic orthopaedic implants. Performing a patch test before the insertion of metallic implants can help determine metal hypersensitivity, but patch test results can be ineffective in predicting adverse outcomes.^{6,7,9,10} Additionally, patch testing is not recommended or indicated unless the patient had a previous allergic reaction to a similar implant.^{6,7,9,10} Furthermore, the risk of hypersensitivity reaction is the same for patients with and without a history of metal sensitivity.^{6,10} Although we cannot confirm that the titanium plates and screws were the cause of LCV in our patient, the timing of the rash appearance and its disappearance after removal of plate and screws makes this association suspected. It is important for orthopaedic surgeons to be aware of this possibility.

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